

## Advanced Life Cycle Assessment in Water-Energy-Food Systems

ABE 5805 Section: in-person

**Class Periods:** MWF Period 3, 9:35 – 10:25 am

**Location:** Frazier Rogers Hall Rm. 211

**Academic Term:** Spring 2026

### Instructors:

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Office Hours: Friday 10:30-11:30 am or by appointment.

### Course Description

Introduction and application of life cycle assessment (LCA) to evaluate the environmental impacts of various products, processes, or services related to the water-energy-food nexus. Additional topics include planetary boundaries, systems thinking, circular economy, mass and energy balances, life-cycle costing, social LCA and sensitivity and uncertainty analysis. This is an interdisciplinary course open to students from any major. (3 credits)

### Course Pre-Requisites / Co-Requisites

### Course Objectives

After completing this course students will be able to:

- Recognize global sustainability challenges within the water-energy-food nexus.
- Explain what life cycle assessment is and how it is applied.
- Investigate the environmental impacts of a product, process or service within water-energy-food systems using life cycle assessment, including sensitivity and uncertainty analysis.
- Analyze, evaluate and communicate life-cycle assessment results via oral presentation and written report.

### Materials and Supply Fees - None

**Required Textbooks and Software** - There is no required textbook for this course. Access to all readings and course materials will be provided to students on Canvas. Students will be able to access the LCA software to be used in this course via the ABE virtual workstation.

### Attendance Policy, Class Expectations, and Make-Up Policy

- Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:  
<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>  
<https://catalog.ufl.edu/graduate/regulations>
- All assignments/class deliverables are due by 11:59 pm on the day specified for full credit. 10% deduction/day thereafter. Maximum deduction is 50%. Late submissions will be allowed with no penalty for emergencies or other extenuating circumstances as described in the attendance policies above.

### Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Assignments (9)	225	38%
Quizzes (3)	75	12%
Midterm Presentation	50	8%
Final Presentation	50	8%
Final Report	100	17%
Grad Student Project	100	17%
	600	100%

### ***Grading Policy***

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at: [UF Graduate Catalog](#) and [Grades and Grading Policies](#)

### ***Course Schedule***

<u>Week</u>	<u>Topic</u>	<u>Due</u>
1	Class Overview, Planetary Boundaries, Sustainability	--
2	Overview and Applications of LCA	Assignment 1
3	Goal, Scope & System Boundary	Assignment 2
4	Life-cycle Inventory	Quiz 1 & Assignment 3
5	Data Quality and Life-cycle Impact Assessment	Assignment 4
6	Working in SimaPro	Assignment 5
7	Sensitivity and Uncertainty Analysis	Assignment 6
8	Project Work Week	Quiz 2 & Assignment 7
9	Mid-term Project Presentations	Midterm Presentation
10	Life Cycle Costing, and Social LCA	--
11	Presenting and Communicating Results	Assignment 8
12	Project Work Week	Quiz 3 & Assignment 9
13	Project Work Week	Grad Student Project
14	Final Project Presentations	Final Presentation
15	Finalize Project Reports	Project Report

### ***Readings***

- Johan Rockström, et al (2024) Planetary Boundaries guide humanity's future on Earth. Nature Reviews Earth & Environment. <https://doi.org/10.1038/s43017-024-00597-z>
- Walter Klopffer (2014) Background and Future Prospects in Life Cycle Assessment, LCA Compendium – The Complete World of Life Cycle Assessment, DOI 10.1007/978-94-017-8697-3\_1
- ISO14040 (2006) Environmental management — Life cycle assessment — Principles and framework
- ISO14044 (2006) Environmental management — Life cycle assessment — Requirements and guidelines
- Mary Ann Curran (2017) Goal and Scope Definition in Life Cycle Assessment, LCA Compendium – The Complete World of Life Cycle Assessment, DOI 10.1007/978-94-024-0855-3\_1
- Anne-Marie Tillman, et al (1993) Choice of system boundaries in life cycle assessment. J. Cleaner Prod. 1994 Volume 2 Number 1
- Mary Ann Curran (2012) Life Cycle Assessment Handbook: A Guide for Environmentally Sustainable Products, Scrivener Publishing LLC

### ***Description of Course Elements:***

**Lectures:** The course is divided into weekly modules. Each week's topic and supporting information will be introduced using a lecture format, and supported with in-class activities, small and large-group discussions, readings, videos, and an assignment. Lecture slides and other supporting material will be provided on the week's Canvas page.

**Assignments:** There will be an assignment each week related to the weekly topic. In some cases, we will start the assignment in class on Fridays, and all assignments will be due the following Thursday by 11:59 pm. Most assignments will directly relate to a component of the LCA class project. Others will serve to emphasize sustainability related concepts. Prior to the Friday class meetings, students may be required to complete a reading or watch a video to prepare for the in-class activity/assignment. A rubric will accompany each assignment outlining the expectations and point allocation for grading.

Assign. #	Description
1	Complete the EN-ROADS simulator activity and submit a written report outlining proposed greenhouse gas emissions reduction plan.
2	Read two articles on a topic of choice related to sustainability grand challenges and answer a questionnaire.
3	Complete a Miro Board-based brainstorming activity, identify three published LCAs on your project topic.
4	Review three published LCAs on your project topic and answer a questionnaire
5	Define the goal and scope, and system boundary (using a system boundary diagram) for your LCA.
6	Complete the practice LCA exercise using Simapro.
7	Complete the practice sensitivity and uncertainty analysis exercise using Excel Macros.
8	Construct a life cycle inventory for your LCA project using at least five published sources.
9	Write a 300-word essay describing the economic and social impacts of your LCA topic.

**Quizzes:** Three quizzes will be given in class throughout the semester to assess students' understanding and application of the lecture material. The quizzes will be delivered and graded via Canvas.

Quiz #	Description
1	Sustainability topics and defining the goal and scope of an LCA
2	Interpreting LCA results and uncertainty in LCAs
3	The three pillars of LCAs and broader impacts

**Class Project and Deliverables:** Over the course of the semester, students will carry-out an LCA on a topic/system of their choice. Several of the weekly assignments will serve as building blocks toward completion of the LCA project. Students will work as individuals or in teams depending on the number of students in the class. If working in teams, each student will complete a mid-term and final peer evaluation to provide feedback on individual performance within the team. As the project comes together, students will be required to complete three project deliverables. A rubric will accompany each deliverable outlining the expectations and point allocation for grading.

- **Midterm Oral Presentation** – Students will prepare a scientific poster that describes the goal, scope, and system boundary of the LCA, and present the poster in class for critical feedback.
- **Final Oral Presentation** – Students will prepare a 10 min PowerPoint presentation that provides an overview of all four components of the LCA (goal and scope definition, life cycle inventory, life cycle impact assessment, and interpretation of results) and present in class for critical feedback.
- **Final Written Report** – Student will prepare a report including abstract, introduction, methods, results, discussion and conclusion, describing the complete LCA in detail and formatted as a scientific manuscript.

**Project Work Weeks:** Time will be given in class to work on the LCA projects and ask questions. Guest presentations and supplementary lectures may also be given during these weeks.

**Graduate Student Project:** Graduate students will be required to prepare and present a lecture and/or activity on a topic related to LCA. This could include teaching the rest of the class how to use an existing streamline LCA tool, or presenting an LCA related case study to the class, etc. Project topics will be approved by the instructors, and students will be expected to prepare a 30-50 min lecture and/or activity with a supporting lesson plan.

### ***Students Requiring Accommodations***

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

### ***Course Evaluation***

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.ua.ufl.edu/public-results/>.

### ***In-Class Recording***

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

### ***University Honesty Policy***

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates

academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### ***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Undergraduate/Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, [jpennacc@ufl.edu](mailto:jpennacc@ufl.edu)
- Pamela Dickrell, Associate Dean of Student Affairs, 352-392-2177, [pld@eng.ufl.edu](mailto:pld@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### ***Software Use***

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

### ***Campus Resources:***

#### **Health and Wellness**

##### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

##### **Sexual Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

##### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

## Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.  
<https://lss.at.ufl.edu/help.shtml>.

**Career Connections Center**, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio**, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus**: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

**On-Line Students Complaints**: <https://distance.ufl.edu/state-authorization-status/#student-complaint>.